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Anatomie des Ductus Pancreaticus Major

Eine duodenoskopische-radiologische Untersuchung

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Anatomy of the Pancreatic Duct A Duodenoscopic-Radiological Study

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Summary

Diagnosis of pathological changes in endoscopic-radiological pancreatograms relies on the knowledge of normal anatomy of the pancreatic duct. For this purpose pictures of patients without pancreatic disorders were evaluated. The values arc given in medians and decile ranges (i.e. 10–90%). The lenght of the pancreatic duct (n = 48) was calculated with a median $\bar{x} = 20.1$ cm (decile range D.R. = 5.4 cm). Minor variations of the duct caliber seem to be normal. The values for maximal and minimar width in the three main segments of the pancreatic duct were: head: $\bar{x}$ max. = 4.8 (D.R. = 2.3 mm), $\bar{x}$ min. = 3.4 (D.R. = 1.7 mm). Body: $\bar{x}$ max. 3.5 (D.R. = 1.3 mm), $\bar{x}$ min. = 2.7 (D.R. = 1.1 mm). Tail: $\bar{x}$ max. 2.4 (D.R. = 0.9 mm), $\bar{x}$ min. = 1.6 (D.R. = 0.9 mm). In addition the topography in correlation to the spine and the course of the pancreatic duct were studied. In 54% of the patients Vater's papilla was located in the middle third of the second portion of the duodenum.

Key-Words: Duodenoscopy, pancreaticography, pancreatic duct anatomy.

Anatomie des Pankreasganges. Eine duodenoskopisch-radiologische Studie

Die Diagnostik pathologischer Befunde bei der retrograden Pankreatographie setzt die Kenntnis der normalen Anatomie des Pankreasgangsystems voraus. Zu diesem Zweck wurden Pankreatogramme von Patienten ohne Anhalt für Pankreaserkrankungen ausgewertet. Die durchschnittliche Länge des Pankreasganges, ermittelt bei 48 Patienten, betrug 20,1 cm mit einem Dezilbereich von 5,4 cm. Kleinere Kaliberschwankungen gehören zum Normalbefund. Maximale und minimale Gangbreite wurden im Kopfbereich mit 4,8 bzw. 3,4 mm gemessen, im Korpusabschnitt mit 3,5 bzw. 2,7 mm und im Schwanzbereich mit 2,4 bzw. 1,6 mm. Ferner wurde die topographische Anatomie des Ganges in Relation zur Wirbelsäule untersucht. Bei 54% der Patienten lag die Vatersche Papille im mittleren Drittel des zweiten Duodenalsegments.

With the advance of fiberoptic duodenoscopes cannulation of Vater's papilla and retrograde filling of the normal and diseased pancreatic duct became a routine procedure with minimal risks. Hitherto available data on the anatomy of the pancreatic duct were based on autopsy studies or were done intraoperatively under unphysiological conditions. Endoscopic pancreaticography is performed in a conscious patient without any abnormality of the periampullar region which might affect the anatomy of the pancreatic duct.

In the following study based on normal endoscopic pancreatograms the length, width, the course of the duct and the topography of the main pancreatic duct were evaluated.

Material

Out of 262 endoscopic pancreatograms 135 did not show any pathological findings. Of these only 48 were suitable for measurements of the entire length of the pancreatic duct documented on a full-size plate. Assessment of the course, topography and of the width was only possible when the duct was photographed in a strict antero-posterior

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position; in about 50 patients these premises were fulfilled.

Methods

The longitudinal course of the duct was measured with a distance measurerer as used for reading maps, the breadth was evaluated with compasses and ruler. The values for length are given in cm, the values for width in mm. Topographic position of the pancreatic duct was correlated to the vertebral spine, the course was judged in angles rising from the horizontal line.[1]

Statistical analysis was based on the median, the decile and the interdecile range (10–90%), since the *Kolmogoroff-Smirnow*-Test showed that the values were not distributed normally.

For all measurements the duct decreasing continuously in size had to be divided arbitrarily into the anatomical segments head, body and tail. The head region ended 2 cm caudad the ductal knee, the remaining duct was divided in two equal parts choosen as body and tail portion. Since the duct becomes more and more narrow, in many cases also showing variation in calibre, maximal and minimal values were established within the head, body and tail segment. The accuracy of the measurements was 0.5 mm.

Results

1. Length of the main pancreatic duct (n = 48)

Statistical evaluation gave a median of 20.1 cm, a decile 10 of 17.3, a decile 90 of 22.7 and a decile range of 5.4 cm.

The values ranged from 16.4 to 24.2 cm. In nine patients each the measurements were between 17 and 18, 19 and 20, 20 and 21, 21 and 22 cm indicating a peak incidence in this range (Fig. 1).

[1] In order to avoid mistakes due to the different distances from the abdominal wall to the pancreatic duct only these pictures were taken where the duodenoscope was still in situ.

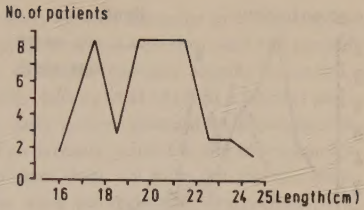

Fig. 1 Length of the pancreatic duct in 48 persons without pancreatic disease. The median is 20.1 cm, the decile range 5.4 cm.

2. Width of the main pancreatic duct

A total of 40 pancreatograms were evaluated:

a) Head region. The maximal values within the pancreatic head ranged from 3 to 7 mm with 70 per cent of all measurements between 4 and 5 mm. The minimal values ranged from 2 to 5 mm with a peak incidence between 3 and 4 mm. Statistics for maximal breadth indicated a median of 4.8 mm with a decile range from 3.8 to 6.1 mm. The minimal width was calculated with a median of 3.4 mm and a decile range from 2.6 to 4.3 mm.

b) Body of the pancreas. Within the body of the pancreas the duct had a maximal width of 2.5 to 5 mm. Three quarters of the duct measurements were within 3–3.5 mm. Minimal values ranged between 2 and 3 mm.

Median for maximal width: 3.5 mm, decile range 3.0 to 4.3 mm.

Median for minimal width: 2.7 mm, decile range 2.2 to 3.3 mm.

c) Tail of the pancreas. The maximal width in this region was 1.5 to 3 mm with a peak incidence between 2 and 2.5 mm. The minimal values ranged from 1 to 2 mm.

Median for maximal width: 2.4 mm, decile range 2.0 to 2.9 mm.

Median for minimal width: 1.6 mm, decile range 1.1 to 2.0 mm (Fig. 2).

3. Topography of the main pancreatic duct

The following topographic correlations between the different segments of the pancreatic duct and the spine were established:

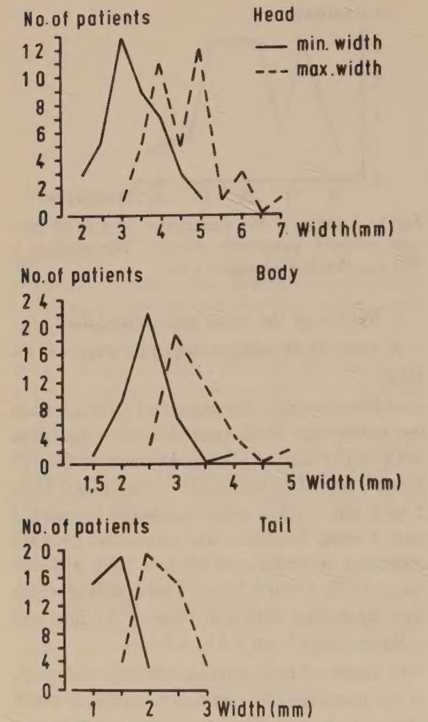

Fig. 2 Distribution of maximal and minimal diameters of the pancreatic duct within the different part of the pancreas (n = 40). For details see text.

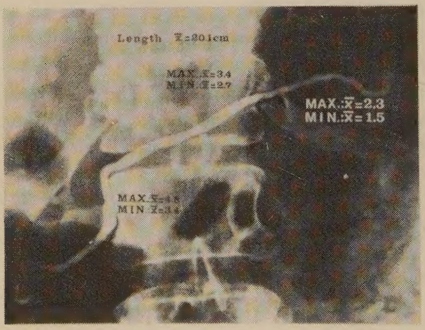

Fig. 3 X-ray picture of a normal main pancreatic duct. Moderate calibre fluctuations especially in the pancreatic tail can be seen. Medians of length and maximal and minimal width are added.

a) Head of the pancreas. In 50 pancreatograms the centre between papilla and genu was situated three times in front of the twelfth thoracic vertebra, in 19 patients at the height of the first lumbar vertebra, in 21 subjects opposite to the second and in 7 subjects opposite to the third lumbar vertebra. In four fifth of all cases, therefore, the pancreatic duct was projected near the first or second lumbar vertebra.

b) Body of the pancreas. In one patient the duct ran in front of the eleventh, in 17 subjects in front of the twelfth thoracic vertebra. In 19 patients it was found opposite to the first, in 13 instances opposite to the second lumbar vertebra.

c) Tail of the pancreas. Out of 45 pancreatograms the tail portion of the duct was projected 6 times near the eleventh thoracic vertebra, 21 times near the twelfth thoracic vertebra, 15 times in front of the first and 3 times in front of the second lumbar vertebra.

Summarizing the head portion is most often situated in height of the second lumbar vertebra, the body portion in front of the first lumbar vertebra, the tail segment is often reaching the twelfth thoracic vertebra. So about 90.3% of all pancreatograms are within the 12 thoracic vertebra and the second lumbar vertebra.

4. Course of the main pancreatic duct

Each segment of the pancreatic duct was correlated with a horizontal line placed through the ampulla of Vater. The duct was virtually straightened by drawing a line from the starting to the end point of each ductal segment, the angles were grouped in 20 degree ranges.

a) Head portion. In 23 patients the duct started vertically, in 18 subjects the rise was 60–80 degrees, in 7 patients 40–60°. In one patient each the angle was 30° and 0°. The mean rise averaged 75°.

b) Body portion. In 17 subjects the body portion was running horizontally, in 8 patients it was rising from 0–20° and in 20 pa-

tients from 20–40°. The rest of 5 ducts took a steeper course. The mean angle in this segment was 19°.

c) The course of the tail duct varied considerably including descension in 5 patients and a steep course of 60–80° in 8 patients. Most common, however, was a horizontal (11) and a sightly ascending (10) course. Average rise was 21°.

5. Position of Vater's ampulla

In 8 patients Vater's papilla was situated in the upper third of the descending part of the duodenum, in 27 patients the ducts flew into the middle third and in 15 subjects the papilla was found in the lower third of the descending portion of the duodenum.

Discussion

In familiar textbooks on anatomy (4, 11) the length of the pancreatic duct is mentioned ranging from 15 to 25 cm. Our minimal value of 16.4 cm and the maximal length of 24.2 cm are in good aggreement with these anatomical data. There is a marked discrepancy between the data given on the width of the duct between anatomical findings of 2–4 mm and the radiological findings of 6 to 7 mm (2, 3, 8, 10). *Birnstingl* (5) is reporting an extreme value of 9.2 mm. In the literature most reports are concerned with the correlation of the body of the pancreas and the spine having a position in front of the first or second lumbar vertebra (9, 11). *Hafferl* (6) observed the body most often opposite to the second lumbar vertebra, *Benninghoff-Görtler* (4) reports that the body often reaches the twelfth thoracic vertebra. In our pancreatograms the pancreatic body crossed the spine in 98% between the twelfth thoracic vertebra and the second lumbar vertebra. One may assume in accordance with *Adlung* et al. (1) that a normal pancreatic duct system guarantees a continuous flow of pancreatic juice. On the other hand a normal duct does not rule out chronic pancreatitis with parenchymal destruction. We do, however, not believe, as *Wiesner* et al. (12) do that marked variations in calibre size and irregular outlining of the duct is compatible with normal histology of the gland. Data on length and, more important, on width in "normal" pancreatograms may help to establish guidelines for the analysis of pancreatograms in chronic pancreatitis with only minor ductal changes.

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